NIST Special Publication 800-137

Information Security Continuous Monitoring for Federal Information Systems and Organizations

Holistic Continuous Monitoring and CAESARS FE

NIST Continuous Monitoring Architecture Workshop

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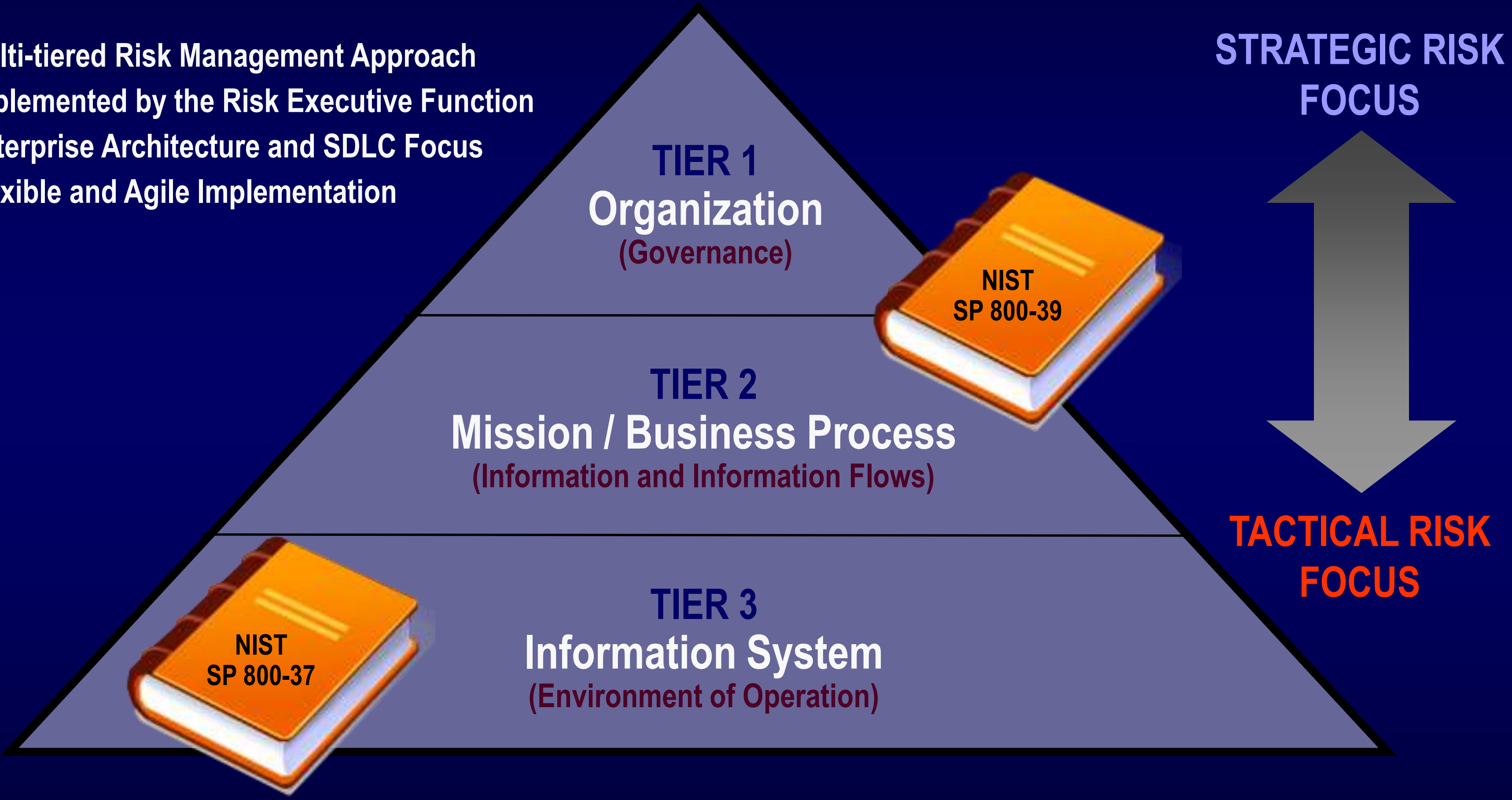
Enterprise-Wide Risk Management

- Multi-tiered Risk Management Approach
- Implemented by the Risk Executive Function
- Enterprise Architecture and SDLC Focus
- Flexible and Agile Implementation



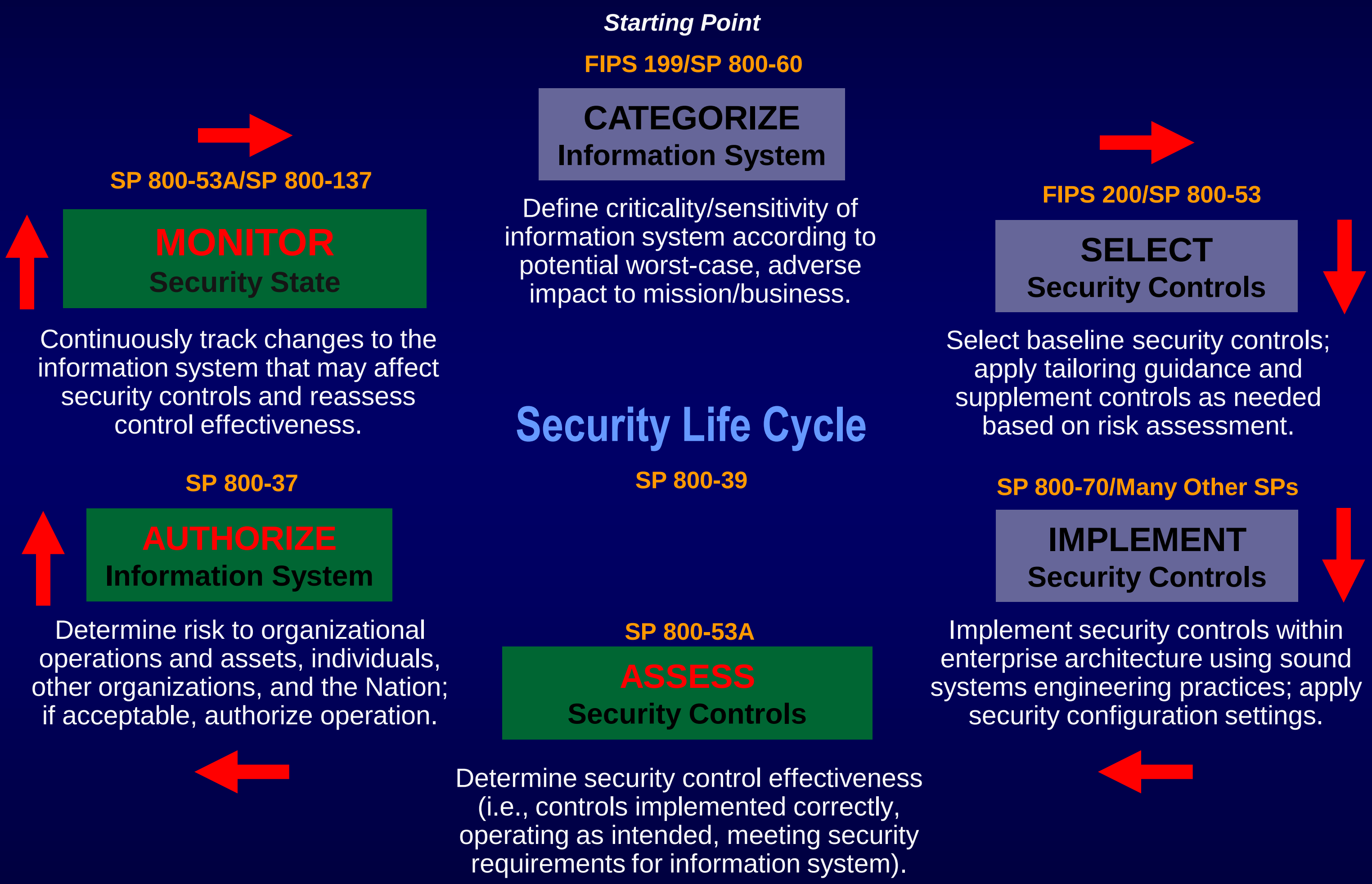
Characteristics of Risk-Based Approaches
(1 of 2)

- Promotes near real-time risk management and ongoing system authorization through the implementation of robust continuous monitoring processes.
- Integrates information security more closely into the system development life cycle.
- Links risk management processes at the information system level to risk management processes at the organization level through a risk executive (function).

Characteristics of Risk-Based Approaches
(2 of 2)

- Encourages the use of automation to increase consistency, effectiveness, and timeliness of security control implementation and functionality
- Provide senior leaders the necessary information to make credible, risk-based decisions with regard to the information systems supporting their core missions and business functions
- Establishes responsibility and accountability for security controls deployed within information systems.

Continuous Monitoring & the RMF



Starting Point

FIPS 199/SP 800-60

CATEGORIZE
Information System

Define criticality/sensitivity of information system according to potential worst-case, adverse impact to mission/business.

FIPS 200/SP 800-53

SELECT
Security Controls

Select baseline security controls; apply tailoring guidance and supplement controls as needed based on risk assessment.

SP 800-70/Many Other SPs

IMPLEMENT
Security Controls

Implement security controls within enterprise architecture using sound systems engineering practices; apply security configuration settings.

SP 800-53A

ASSESS
Security Controls

Determine security control effectiveness (i.e., controls implemented correctly, operating as intended, meeting security requirements for information system).

SP 800-37

AUTHORIZE
Information System

Determine risk to organizational operations and assets, individuals, other organizations, and the Nation; if acceptable, authorize operation.

SP 800-53A/SP 800-137

MONITOR
Security State

Continuously track changes to the information system that may affect security controls and reassess control effectiveness.

Security Life Cycle

SP 800-39

Continuous Monitoring Definition

- Continuous* monitoring (generic) is maintaining ongoing awareness to support organizational risk decisions.
- Information security continuous* monitoring is maintaining ongoing* awareness of information security, vulnerabilities, and threats to support organizational risk management decisions.

* The terms “continuous” and “ongoing” in this context mean that security controls and organizational risks are assessed, analyzed and reported at a frequency sufficient to support risk-based security decisions as needed to adequately protect organization information.

Continuous Monitoring Objectives

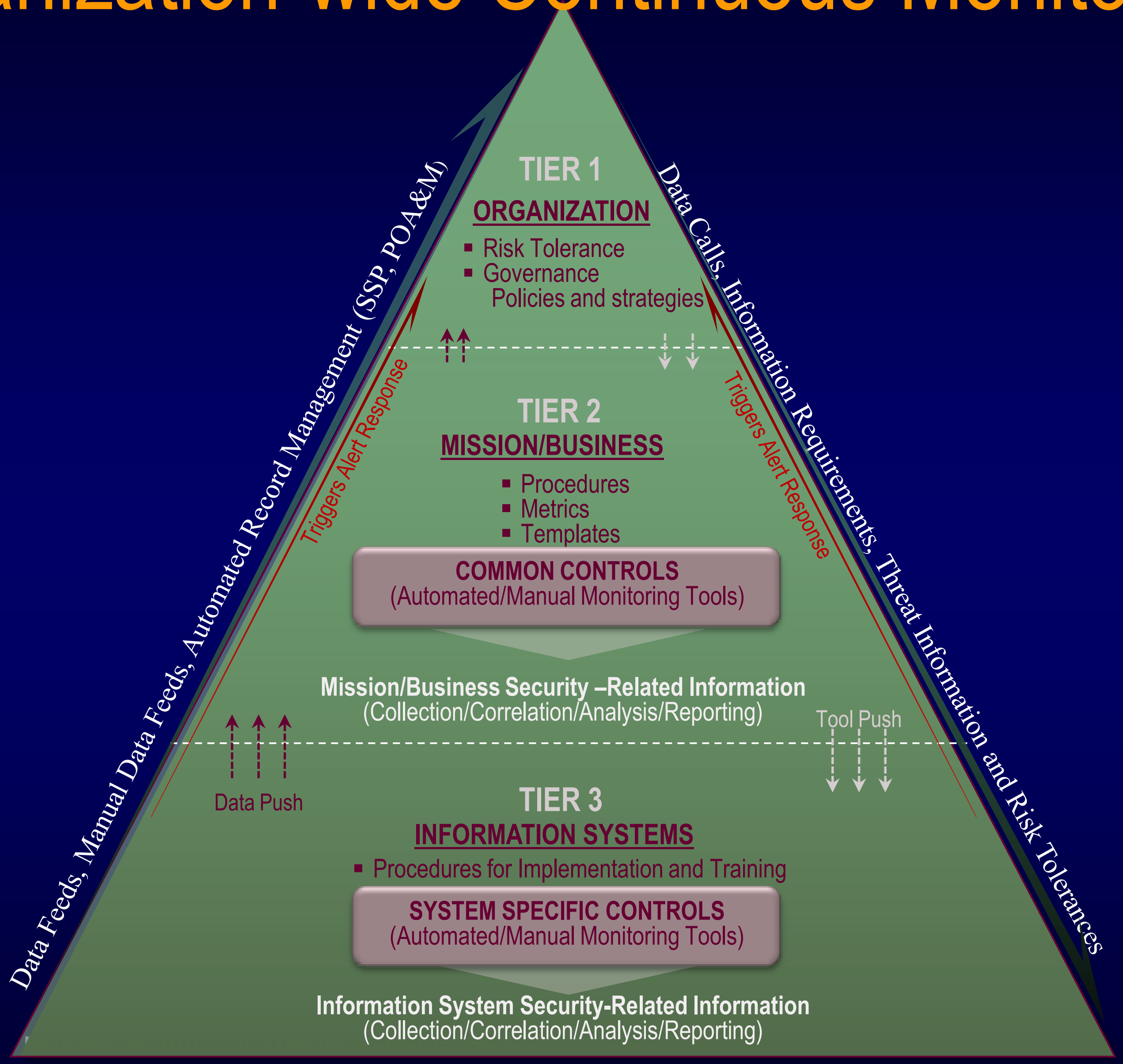
- Conduct **ongoing monitoring of the security** of an organization's information, applications, networks, and systems, and **respond to risk** as situations change.
- Determine if the **security controls** implemented within an information system or inherited by the system **continue to be effective over time** in light of the inevitable changes that occur.
- Ensure monitoring and reporting frequencies remain aligned with threats and organizational risk tolerance by **monitoring the monitoring strategy itself.**

Precursors to NIST SP 800-137

The Continuous Monitoring Process, as described in NIST SP 800-137, is consistent with and an expansion of:

- Step Six of the Risk Management Framework (NIST SP 800-37 Revision 1)
- Appendix G of NIST SP 800-37 Revision 1
- Control CA-7 from NIST SP 800-53 Revision 3

Organization-wide Continuous Monitoring



TIER 1

ORGANIZATION

- Risk Tolerance
- Governance

  Policies and strategies

TIER 2

MISSION/BUSINESS

- Procedures
- Metrics
- Templates

COMMON CONTROLS
(Automated/Manual Monitoring Tools)

Mission/Business Security –Related Information
(Collection/Correlation/Analysis/Reporting)

TIER 3

INFORMATION SYSTEMS

- Procedures for Implementation and Training

SYSTEM SPECIFIC CONTROLS
(Automated/Manual Monitoring Tools)

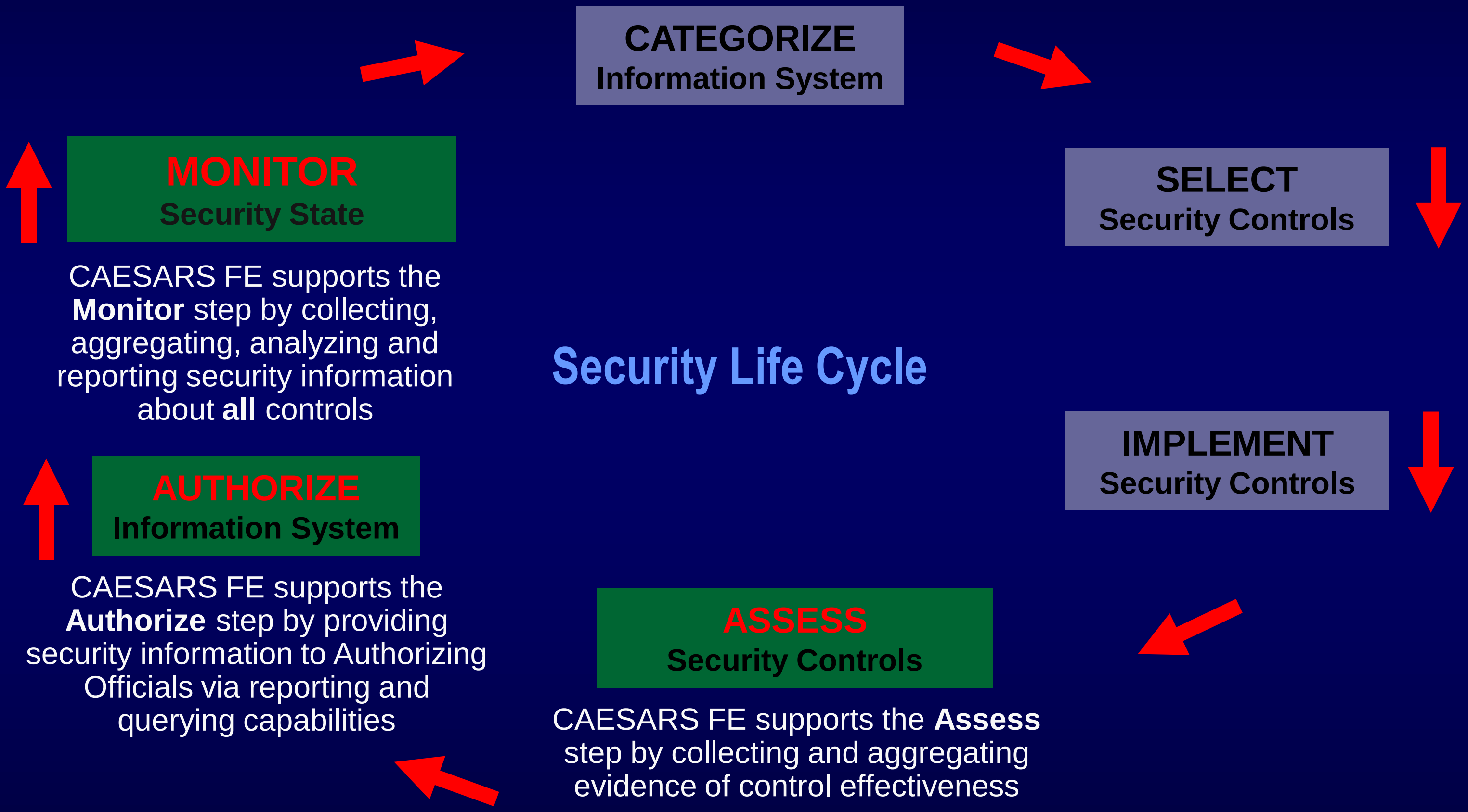
Information System Security-Related Information
(Collection/Correlation/Analysis/Reporting)

Data Feeds, Manual Data Feeds, Automated Record Management (SSP, POA&M)
Data Calls, Information Requirements, Threat Information and Risk Tolerances
Triggers Alert Response
Triggers Alert Response
Data Push
Tool Push

Technologies for Enabling Continuous Monitoring

- Direct data gathering
  - Eleven security domains
- Aggregation and analysis
  - Security information and event management (SIEM)
  - Management dashboards
- Automation and Data Sources
  - Security content automation protocol (SCAP), XML, etc.
  - Data sources

CAESARS Framework Extension (FE) Support of the RMF



CATEGORIZE
Information System

SELECT
Security Controls

IMPLEMENT
Security Controls

ASSESS
Security Controls

CAESARS FE supports the **Assess** step by collecting and aggregating evidence of control effectiveness

AUTHORIZE
Information System

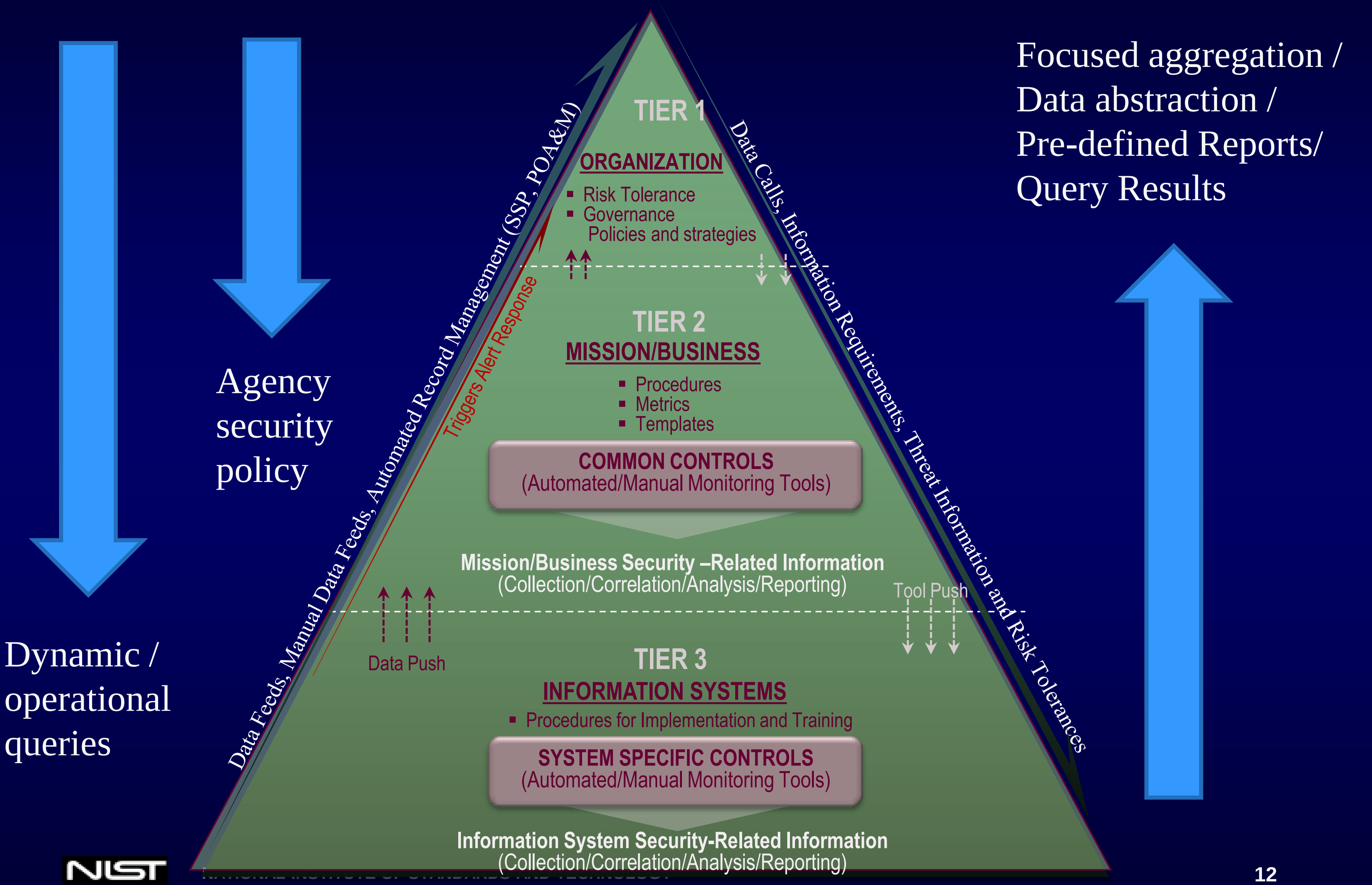
CAESARS FE supports the **Authorize** step by providing security information to Authorizing Officials via reporting and querying capabilities

MONITOR
Security State

CAESARS FE supports the **Monitor** step by collecting, aggregating, analyzing and reporting security information about **all** controls

Security Life Cycle

CAESARS FE Supports CoMo at All Three Tiers



Agency security policy

Dynamic / operational queries

Focused aggregation / Data abstraction / Pre-defined Reports/ Query Results

Data Feeds, Manual Data Feeds, Automated Record Management (SSP, POA&M)

Triggers Alert Response

Data Calls, Information Requirements, Threat Information and Risk Tolerances

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TIER 3

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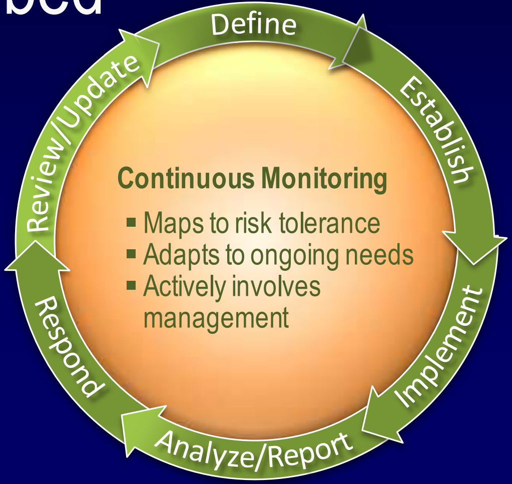
CAESARS FE can provide layer relevant data

Continuous Monitoring Process Steps

The Continuous Monitoring process, as described in NIST SP 800-137, consists of seven steps:



- Define strategy
- Establish measures and metrics
- **Establish monitoring frequencies**
- **Implement the monitoring program**
- **Analyze security-related information (data) and report findings**
- Respond with mitigation actions OR reject/avoid, transfer, or accept risk
- **Review and update monitoring strategy and program**

CAESARS FE

CAESARS FE Support for CoMo Step 3

Establish Monitoring and Assessment Frequencies

- 800-137 Guidance: Monitor metrics/measures and **each** control with varying frequencies
  - CAESARS FE supports monitoring at varying frequencies in accordance with the specific requirements and risk tolerance at each organization
  - Continual vs. Continuous (periodicity from milliseconds to years)

CAESARS FE Support for CoMo Step 4

Implement the Continuous Monitoring Program

- The CAESARS FE model can support full achievement of the implementation step
- CAESARS FE supports monitoring of **all** controls regardless of input method (i.e., manual or automated)
  - The necessary data standards must exist for the applicable data domains!!
- CAESARS FE is **NOT** only focused on technical control evaluation
  - Example 1: CAESARS FE could leverage an 800-53 control XML representation
  - Example 2: CAESARS FE could leverage a POAM XML representation

CAESARS FE Support of CoMo Step 5

Analyze Data and Report Findings

- Supports varying degrees of granularity for different report recipients:
  - Core capabilities – Pre-defined reports (views) tailored for organizational requirements (e.g., the three tiers)
    - Different views for operations, decision makers, and compliance reports
  - Advanced capabilities – Dynamic/selective querying from Tier 1 down
    - Eliminates need for agencies to aggregate **all** low level data up to the agency level
      - Reduces security risk and minimizes storage/network throughput issues
  - CAESARS FE supports dynamic adjustment of scoring algorithms, parameters, and weights

CAESARS FE Support for CoMo Step 7

Review and Update Monitoring Strategy and Programs

- CAESARS FE supports dynamic adjustment of scoring algorithms, parameters, and weights
  - Use reports, queries, and scoring information to examine trends, determine if frequencies and metrics are appropriate, etc.

Continuous Monitoring Automation:
The Need for Caution (1 of 2)

- Automation of monitoring using standard reference architectures (e.g., CAESARS FE) ***supports*** holistic monitoring and ***is strongly encouraged***, but…
- The security-related information generated via automated tools is not the end of the story:
  - Agencies evaluate and act upon the data based on a well-defined risk management process (SP 800-39)
  - The tools themselves have to be monitored for accuracy and integrity on a regular basis

Continuous Monitoring Automation:

The Need for Caution (2 of 2)

Automated tools may lead to a false sense of security:

- If **all** controls are **not** taken into account when monitoring, an **incomplete picture of overall security posture** and risk is presented:
  - Risk scores may not be comprehensive, i.e., an automated tool cannot score risks about which it has no information
  - Risk scoring is often based solely on automation of technical controls and thus is not a substitute for monitoring other essential operational and management controls nor can it determine how security failures will affect organization functions and mission

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